

Beyond Hearing Aid Fitting: Patient-Centered Aural Rehabilitation in Adults with Acquired Sensorineural Hearing Impairment

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Abstract

Hearing impairment is one of the most commonly reported chronic health problems in the older adult population, and is associated with psychosocial and quality of life handicaps (Gordon-Salant, 2006; Jennings, 2005; Weinstein, 1996). Both scientific and clinical evidence demonstrate that adults with handicapping hearing impairment benefit from rehabilitative services offered by audiologists (Weinstein, 1996). There are many rehabilitative services and programs available to this population of patients, however, there is evidence to suggest that a typical audiologic consultation does not extend beyond hearing aid fitting and orientation (Jennings, 2005; Southall et al., 2010; Sweetow & Palmer, 2005), overlooking other potentially useful and critical components of aural rehabilitation. Although hearing aids have been shown to be efficacious in the rehabilitation of hearing impairment by successfully improving the quality of life and communicative abilities of hearing aid users, (Kochkin, 1992; Kricos, Erdman, Bratt, & Williams, 2007; Weinstein, 1996), the use of hearing aids will not address all of the challenges that are created by the presence of hearing impairment (Jennings, 2005). This paper presents an overview of the difficulties experienced by individuals with hearing impairment and seeks to determine best practices in aural rehabilitation by examining the evidence for the efficacy of various aural rehabilitation services and programs available to patients.

Dedication

I dedicate this project to my wonderful family – particularly to my parents, who instilled in me the value of education and the importance of hard work, and to my husband, Matt, for his invaluable patience and encouragement.

Acknowledgment

I would like to express my sincere gratitude to my committee members, Gail Whitelaw, Ph.D., Christy Goodman, Au.D., and Robert Fox, Ph.D. for their advice, encouragement and guidance for this project. I am also greatly appreciative of their support throughout the duration of my graduate studies.

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Table of Contents

Abstract.....	ii
Dedication.....	iii
Acknowledgment.....	iv
Vita.....	v
List of Figures.....	vii
Chapters:	
1. Introduction.....	1
2. The Impact of Acquired Sensorineural Hearing Impairment in Adults.....	3
3. Aural Rehabilitation.....	10
4. Considerations for Patient-Centered Aural Rehabilitation.....	43
References.....	45

List of Figures

Figure 1: The Circle of Change.....	32
Figure 2: The Scaling Line.....	32
Figure 3: Decisional Balance Box.....	33

Chapter 1: Introduction

Hearing impairment is one of the most commonly reported chronic health problems in the older adult population (Gordon-Salant, 2006; Jennings, 2005; Weinstein, 1996). The prevalence of adult-onset sensorineural hearing impairment increases with age and is associated with psychosocial and quality of life handicaps (Weinstein, 1996). Both scientific and clinical evidence demonstrate that adults with handicapping hearing impairment benefit from rehabilitative services offered by audiologists (Weinstein, 1996). There are many rehabilitative services and programs available to adults with acquired sensorineural hearing impairment, including hearing aid fitting and orientation, informational and supportive counseling, communication strategies training, auditory training, and training in speech perception and conversational skills (Southall, Gagné, & Jennings, 2010; Gagné & Jennings, 2000). Despite this fact, many audiologists provide little more than attempting to restore audibility through the use of amplification (Sweetow & Palmer, 2005), and a typical audiologic consultation does not extend beyond hearing aid fitting and orientation (Jennings, 2005; Southall et al., 2010), overlooking other potentially useful and critical components of aural rehabilitation. Although hearing aids have been shown to be efficacious in the rehabilitation of hearing impairment by successfully improving the quality of life and communicative abilities of hearing aid users, (Kochkin, 1992; Kricos, Erdman, Bratt, & Williams, 2007; Weinstein, 1996), the use of hearing aids will not address all of the challenges that are created by the presence of hearing impairment (Jennings, 2005). Sergei Kochkin's series of MarkeTrak articles,

which surveyed hearing aid users and the hearing instrument market, have noted that there are varying levels of satisfaction among hearing aid users (Kochkin, 1996; Kochkin, 2000a; Kochkin, 2000b; Kochkin, 2007). Specifically, this research has shown that some individuals who use hearing aids consistently may continue to experience socially disabling communication difficulties associated with the hearing impairment, especially in background noise (Jennings, 2005; Kochkin, 2000a; Kochkin, 2000b; Kochkin, 2007).

The number of adults with hearing impairment will continue to increase dramatically as the population ages and the communication needs of this population of patients will continue to grow (Gordon-Salant, 2006; Jennings, 2005; Kricos et al., 2007; Weinstein, 1996), so the question of appropriate and efficacious aural rehabilitation is of great importance. It is incumbent upon the audiologist to seek out information regarding best practices, and to implement these practices with their patients. This paper presents an overview of the difficulties experienced by individuals with hearing impairment and seeks to determine best practices in aural rehabilitation by examining the evidence for the efficacy of various aural rehabilitation services and programs available to patients.

Chapter 2: The Impact of Acquired Sensorineural Hearing Impairment in Adults

Physiologic and Psychoacoustic Changes that Accompany Sensorineural Hearing Impairment

Decreases in hearing sensitivity and increased difficulty with speech understanding often accompany advancing age. In order to provide meaningful diagnostic and aural rehabilitative services to adults with sensorineural hearing impairment, it is critical to understand the physiologic and psychoacoustic nature of the auditory impairment that accompanies aging to the extent that the current body of research allows (Hull, 2001a).

The specific pathologies underlying cochlear hearing impairment have been well investigated. Although cochlear hearing impairment can present clinically in a variety of degrees and configurations, generally speaking, all noise-induced or presbycusis cochlear hearing impairments result from a number of underlying pathologies, which can occur in isolation or in any number of combinations. These pathologies include distorted or destroyed stereocilia, death or dysfunction of hair cells, damaged supporting cells within the cochlea, loss of blood flow to the cochlea, reductions in endocochlear potential resulting from atrophy of the stria vascularis, and damage of the basilar membrane (Frisina, 2001; Le Prell, Yamashita, Minami, Yamasoba, & Miller, 2007). Each of these pathologies results in physiologic changes, which in turn lead to cochlear hearing impairment and the accompanying psychoacoustic changes.

As a result of these cochlear pathologies, the inner ear is rendered less effective at processing the complex auditory signals it would otherwise be able to process. Structural

changes within the cochlea, damaged stereocilia, loss of blood flow to the cochlea, and atrophy of the stria vascularis all serve to reduce the sensitivity of the Organ of Corti, effecting both the movement of the basilar membrane and the endolymphatic potential. Further, outer hair cell loss is often the first physiologic change to occur in an impaired cochlea (Le Prell et al., 2007). Hair cell death can occur as a result of oxidative stress that is a product of noise exposure, but has also been shown to occur as a typical aspect of the aging process (Gates & Mills, 2005). Because each outer hair cell is an active mechanism that contributes to important nonlinear properties of the cochlea and is responsible for amplifying incoming auditory inputs from the middle ear system, death and dysfunction of outer hair cells leads to reduced basilar membrane vibration for low level sounds and therefore loss of sensitivity to sound (Frisina, 2001; Moore, 2001). While outer hair cell damage is a common pathology underlying cochlear hearing impairment, inner hair cell dysfunction and death also leads to a loss of sensitivity to sounds. Inner hair cell damage leads to a reduced efficiency of transduction and can occur as a result of metabolic disturbance or structural problems, such as shrinkage of the tectorial membrane (Moore, 2001).

These pathologic changes have a negative effect on the psychoacoustic characteristics of the cochlea. Cochlear damage affects frequency resolution, loudness perception, and temporal resolution. Frequency resolution, which is quantified with psychophysical tuning curves, refers to the ability of the auditory system to resolve components of a spectrally complex sound, and is highly dependent upon the active filtering that occurs in the cochlea (Moore, 1996). In the case of cochlear hearing impairment, this active mechanism is typically damaged or completely nonfunctional,

which results in much broader tuning curves and decreased frequency selectivity (Moore, 2001). Cochlear damage also adversely affects loudness perception, as a result of a reduced dynamic range. Dynamic range refers to the range of sound levels that are audible, without being uncomfortably loud (Roeser, Valente, and Hosford-Dunn, 2007). In the case of a person with cochlear hearing impairment, the loss or reduction of the effects of the cochlear amplifier, resulting from death and dysfunction of outer hair cells, will cause detection thresholds to be higher than normal. Although thresholds are elevated, the level at which sounds become uncomfortably loud remains normal, leading to loudness recruitment and an impaired perception of loudness (Moore, 1996). Finally, cochlear hearing impairment also has a negative impact on temporal resolution. Because temporal resolution depends both on the analysis of the time pattern within frequency channels as well as across frequency channels within the cochlea, there is some variation in the ways in which temporal processing is affected by cochlear damage (Moore, 1996). In general, loss of the nonlinear properties of the cochlea leads to poorer gap detection and increased difficulty following the temporal structure of sounds.

Real-World Correlates of Physiologic and Psychoacoustic Changes

The physiologic and psychoacoustic changes that occur as a result of damage to the cochlea negatively affect the communication abilities of people with sensorineural hearing impairment. In most cases, this difficulty negatively affects all areas of a person's life, including personal life, work performance, leisure activities, and family life, and can be a threat to the safety of an individual when environmental sounds are inaudible (Weinstein, 1996). While audibility is essential, the difficulties in speech understanding

in noise, temporal processing, and frequency resolution that people with cochlear hearing impairment face are largely due to abnormalities in the perception of suprathreshold sounds. Because of outer hair cell death and dysfunction, spectral details are less well represented in excitation patterns, and the auditory system is limited in its ability to process complex sounds (Moore, 2007).

The ability to understand speech in the presence of background noise is adversely affected as a result of the physiologic and psychoacoustic changes that occur as a result of cochlear damage. Those with cochlear hearing impairment are commonly unsatisfied with their ability to understand speech. Among the most common complaints of those who are older than sixty-five and have significant hearing impairment is difficulty understanding speech, especially in challenging listening situations (Gordon-Salant, 2006). The ability to comprehend speech in the presence of noise is dependent upon audibility of the desired signal, but is also dependent upon perception of sounds that are above the threshold of audibility (Moore, 2007). Any interfering noise could potentially mask the intended signal from being audible to the listener, which is problematic for a person with cochlear hearing impairment who has impaired temporal processing and decreased frequency resolution. Further, several studies have shown that individuals with sensorineural hearing impairment require a greater signal-to-noise ratio than do individuals with normal hearing in order to achieve similar speech understanding (Hawkins & Yacullo, 1984; Killion, 1997). In general, when tested with speech recognition tests in noise, the average signal-to-noise ratio required to achieve a fifty percent word recognition score increased with increasing hearing loss (Killion, 1997). A one-decibel improvement in signal-to-noise ratio corresponds to a six to twelve

percentage point improvement in speech intelligibility in background noise (Christensen, 2000; Dillon, 2001).

In addition, temporal processing plays a significant role in the ability to understand speech in the presence of background noise. Those who have cochlear damage are less able to take advantage of spatial separation of target speech and interfering sounds, as they miss many of those temporal cues (Moore, 1996). In addition, temporal smearing can have a negative impact on speech understanding, both in quiet and in noise (Moore, 2007). Further, a damaged cochlea with impaired temporal processing skills would show difficulty with localization and lateralization of sounds in the environment, as these skills are dependent upon temporal cues as well (Moore, 1996). And, finally, a loss of temporal processing skills would lead to impaired duration discrimination, gap detection, and judgment of temporal order, which lead to difficulties processing complex sounds, including speech sounds (Allen, 2007).

Frequency resolution, which is essential for speech understanding, is also adversely affected by damage to the cochlea. Because this ability is largely dependent upon the active mechanism in the cochlea, and the active mechanism is typically either damaged or nonfunctioning in cases of cochlear hearing impairment, the ability to resolve complex sounds into different frequency components and differentiate between various frequencies becomes significantly impaired (Moore, 1996). This has a significant impact on a person's ability to perceive the important spectral subtleties, and consequently, vowel and consonant identification and discrimination are impaired (Allen, 2007). Small differences in the perception of frequency information can make a big difference in the discrimination of consonant sounds, as is evidenced by the speech understanding

difficulties many people with cochlear hearing loss describe. In addition, loss of frequency resolution will cause increased difficulty distinguishing between pitches, which, in addition to the impact this has on speech perception, would also have an impact on the perception and enjoyment of music.

In addition to the physiologic and psychoacoustic changes that accompany sensorineural hearing impairment, older adults with hearing impairment often experience difficulties in understanding that are disproportionately greater than one might expect based on measured hearing sensitivity alone (Hull, 2001a). The literature reveals that these age-related confounding factors that lead to disproportionately poor speech understanding appear to be related to a decline in the function of the central auditory system, including the brainstem and auditory cortex (Hull, 2001a). Recent research has indicated that older adult listeners with hearing impairment may be at an even greater disadvantage for speech understanding when in less favorable signal-to-noise ratios, due to factors that lie beyond the cochlea. A 2006 study completed by Gordon-Salant revealed that older adults, age sixty-five or older, exhibited increased difficulty with speech understanding as a result of loss of hearing sensitivity as well as age-related changes, such as alterations in auditory processing or cognitive decline, or both (Gordon-Salant, 2006; Humes, 2005; Pichora-Fuller & Souza, 2003). Further, when compared to younger listeners, older adult listeners exhibit speech recognition deficits when identifying stimuli that have been altered in the time domain, such as time-compressed speech, reverberant speech, and accented English (Gordon-Salant, 2006). These difficulties have largely been attributed to an age-related slowing in auditory processing (Chisolm, Willott, & Lister, 2003; Gordon-Salant, 2006; Hull, 2001b).

Several studies have documented the effects of untreated hearing impairment on adults and older adults. In addition to an increased difficulty with every day communication (Arlinger, 2003; Weinstein, 1996) many individuals with untreated sensorineural hearing impairment report a reduction in the quality and quantity of social exchanges (Southall et al., 2010), as well as decline in cognitive function (Cacciatore et al., 1999; Gordon-Salant, 2006) and deterioration of speech perception skills in unaided ears resulting from auditory deprivation (Arlinger, 2003). There is variation from individual to individual, however, as the degree of self-reported hearing handicap is positively correlated with the degree of hearing impairment (Wiley, Cruickshanks, Nondal, & Tweed, 2000). In addition, self-perceived social and emotional handicap is associated with a decline in physical and psychosocial function (Weinstein, 1996). Individuals with untreated hearing impairment also report that they experience compromised quality of life and that the quality of life of their spouses is also negatively affected (Joore, Potjewijd, Timmerman, & Anteunis, 2002; Wallhagen, Strawbridge, Shema, & Kaplan, 2004). Further, the results of a longitudinal study in Amsterdam, whose participants ranged in age from fifty-five to eighty-five years old, suggested that hearing impairment was positively associated with depressive symptoms and loneliness, and was negatively associated with feelings of self-mastery, scores on self-efficacy, and social network size (Kramer, Kapteyn, Kuik, & Deeg, 2002). Provision of aural rehabilitation is a critical consideration for these individuals in order to avoid the potentially detrimental effects of untreated hearing impairment (Kricos, 2006).

Chapter 3: Aural Rehabilitation

Introduction to Aural Rehabilitation

Since the establishment of aural rehabilitation following World War II, the importance of aural rehabilitation services within the discipline of audiology and the types of services provided by rehabilitative audiologists have been in constant evolution (Gagné & Jennings, 2000). As Raymond H. Hull eloquently describes, aural rehabilitation and the strategies utilized in the process of aural rehabilitation center on the impact of a hearing impairment on communication as experienced by adults who possess it, in order to overcome the handicapping effects of the hearing impairment (Hull, 2001c). Similarly, according to Weinstein (1996), the term aural rehabilitation describes the application of the latest, cutting edge knowledge and technology to enhance communication and interpersonal functioning in adults with hearing impairment, disability, or handicap. Further, aural rehabilitation is a process extending over a period of time wherein the rehabilitative needs of patients evolve as a function of time (Gagné & Jennings, 2000). Aural rehabilitation is considered to be efficacious when it serves to reduce the communication difficulties or disabilities experienced by a patient and enhance psychosocial well being, and when the functional improvements remain long after the rehabilitation was initiated (Stephens, 1984; Weinstein, 1996).

Within the realm of aural rehabilitation, there are numerous services and programs available to adults with acquired sensorineural hearing impairment. These include hearing aid fitting and orientation, informational and supportive counseling,

utilization of assistive technology, communication strategies training, and training in speech perception and conversational skills (Kochkin, 2000b; Kochkin, 2007; Gagné & Jennings, 2000; Southall et al., 2010, Weinstein, 2000). Despite the fact that audiologists have numerous tools and resources available to help individuals with hearing impairment move in the direction of reduced communication difficulties and enhanced psychosocial well being, it has been reported that the typical audiologic consultation and provision of aural rehabilitative services does not extend beyond hearing aid fitting and orientation (Jennings, 2005; Southall et al., 2010). Although hearing aids have been described as the single most important part of the audiologic rehabilitation process (Weinstein, 1996), they constitute only one part and, in some cases, may not be the most appropriate form of treatment (Stephens, 1984; Weinstein, 1996).

Components of Aural Rehabilitation: Amplification

Efficacy of Amplification.

The use of hearing aids is the primary treatment for acquired sensorineural hearing impairment (Weinstein, 1996), and the efficacy of hearing aids for improving communication performance has been well documented (Kochkin, 1992; Kricos, et al., 2007; Weinstein, 1996). According to Kochkin (2010), the goal of treating hearing impairment with hearing aid technology is to “optimally amplify users’ residual auditory area and thereby help them reclaim listening situations that are personally important to them.” In general, hearing aids attempt to compensate for the loss of sensitivity that results from hearing impairment, but in the case of sensorineural hearing impairment are limited in their ability to

compensate for the suprathreshold changes in perception described above, such as reduced temporal processing, frequency resolution, and speech understanding in noise. Through the implementation of directional microphones, wide dynamic range compression (WDRC), and multiple channels, modern hearing aids are much more sophisticated in their attempt to overcome the effects of cochlear hearing loss than the conventional linear hearing aids that preceded them.

Modern hearing aids employ sophisticated mechanisms that attempt to separate speech signals from background noise, subsequently altering both, with the goal of facilitating speech understanding by improving the signal to noise ratio (Bell, Creeke, & Lutman, 2010). One of the most effective mechanisms employed in order to improve the signal to noise ratio for a listener with a hearing aid is the use of directional microphones, which have sensitivity to sounds from some directions and attenuate signals from other directions. Directional microphones can be fixed or adaptive and are useful for providing spatial and temporal cues that are essentially lost to the damaged cochlea. While there can be considerable variation in the benefit each patient receives from directional microphones (Bell et al., 2010), research has shown that the use of directional microphones in hearing aids improves speech understanding in noisy environments across hearing aid wearers with mild, moderate, and severe hearing impairments (Compton-Conley, Neuman, Killion, & Levitt, 2004; Gnewikow, Ricketts, Bratt, & Mutchler, 2009; Valente, Fabry, & Potts, 1995). Specifically, Compton-Conley and colleagues described that there is evidence in the research to suggest that the audiologist could predict a four to five decibel improvement in the signal to noise

ratio in ordinary acoustic settings for an individual with a typical mild to moderate hearing impairment (Compton-Conley et al., 2004).

In addition to the use of directional microphones, hearing aid manufacturers have implemented WDRC in order to attempt to restore the perception of loudness to as close to normal as possible. This nonlinear prescription of amplification is an attempt to make up for the loss of the cochlear amplifier, which would typically occur as a result of properly functioning outer hair cells. With the use of compression, it is possible to amplify weak sounds more than louder sounds, resulting in the wide dynamic range of the input signal being compressed into a smaller dynamic range at the output (Moore, 1996). Specifically, compression allows for understanding of various levels of speech in quiet, and improved understanding of speech in background noise (Moore, 2007). Compression is often implemented differently across various frequency bands, which is referred to as multiband compression. Multiband compression is beneficial because the amount of hearing loss, and therefore the amount of compression needed, varies by frequency, requiring that compression be applied independently in more than one band (Moore, 1996).

Despite the potential for significant positive outcomes resulting from the use of amplification, ageism, stigma, and normalization of hearing loss serve to prevent individuals with acquired sensorineural hearing impairment from identifying and acknowledging their hearing loss (Jennings, 2005). The stigma associated with hearing impairment is often cited among the most important barriers to hearing aid use (Kochkin, 2000a; Kochkin, 2007; Southall et al., 2010).

Further, many individuals choose not to use hearing aids simply because they lead to the perception of feeling old, weak, and disabled (Kochkin, 2007). These factors lead to a delay in help-seeking, as individuals with hearing impairment don't want to be associated with the largely negative societal attitudes toward acquired hearing impairment. When interviewed, the majority of individuals interviewed described the onset of their hearing loss as a stressful and frustrating time, in part due to societal attitudes toward hearing impairment and in part due to their own attitudes about hearing impairment (Southall et al., 2010). This fear of an association with negative stereotypes creates both psychological and social barriers to the uptake of assistive technology, especially amplification (Jennings 2005; Kochkin, 2007).

Although there is resistance to and hesitancy in trying amplification for the first time, it has been demonstrated that first time hearing aid fittings are correlated with improvement in overall quality of life and psychological well being in older adults with hearing impairment (Kricos et al., 2007). A large randomized controlled trial completed in 1990 demonstrated that beneficial treatment effects from hearing aid use emerged as early as six weeks after fitting the hearing aids and were most significant in the areas of social, emotional, and communication function, affect or depression, and cognition (Mulrow et al., 1990). In this same study, the beneficial treatment effects were sustainable four months after the beginning of treatment, and other studies have found that the positive treatment effects are sustainable after one year of hearing aid use (Weinstein, 1996). Further, hearing aid use has been shown to result in a

significant reduction of strain and apprehension associated with communication situations, as well as a reduction in the tendency to withdraw from social interactions (Kricos et al., 2007).

Not surprisingly, those who have accepted the fact that they have a hearing impairment reported using their hearing aids more consistently, and therefore reaping the benefits and achieving greater success with communication (Jerram & Purdy, 2001). In addition, those who regularly use their hearing aids report significantly greater communication performance and use of positive adaptive strategies when compared to those who were fitted with hearing aids, but later discontinued use (Kricos et al., 2007). These differences were noted at work, at home, in social situations, and in both average and adverse listening conditions. In 1992, sixty five percent of hearing aid users were reportedly satisfied with their hearing aids, and reported that they felt as though the hearing aids improved their lives (Kochkin, 1992). Eight out of ten of this same group of hearing aid users would reportedly recommend a hearing aid to a friend. Recent data indicate that despite the significant advances in hearing aid technology, user satisfaction remains somewhat low. Kochkin (2010) reported that only fifty five percent of current hearing aid users would assent to being either “satisfied” or “very satisfied,” and another twenty three percent reported being “somewhat satisfied.” In addition, Kochkin (2010) described that eighty two percent would recommend hearing aids to their friend, which is somewhat higher than one would anticipate based on satisfaction alone.

Limitations of Amplification.

Hearing aids have come a long way in providing listeners who are hearing impaired with better speech understanding, both in quiet and in noise. Modern digital hearing aids have the flexibility to be programmed for various degrees and configurations of hearing loss with very precise frequency shaping and compensation for reduced dynamic range (Moore, 1996). However, hearing aids are somewhat limited in the benefit they can provide, largely because of the nonlinear nature of the cochlea, as well as the distortion that is introduced as a result of damage to the cochlea. In the case of cochlear hearing loss, the underlying pathologies change the way that the cochlea processes complex sounds in such a significant way that reproducing the signal processing capabilities of the cochlea is an ability that has yet to be replicated. While hearing aids have the potential to provide significant benefit for a person, they certainly do not restore hearing to normal.

The majority of hearing aid users are satisfied in one-on-one settings, in quiet, and while watching television, however, many studies have shown that satisfaction typically declined in complex or noisy environments, such as restaurants or large group settings (Gatehouse & Robinson, 1997; Knebel & Bentler, 1998; Kochkin, 1992). One of the most common problems reported by hearing aid users is difficulty understanding speech in background noise (Alcántara, Moore, Kuhnel, & Launer, 2003; Hawkins & Yacullo, 1984). As recently as 1996, only thirty eight percent of hearing aid users found their hearing aids to be helpful when listening in background noise (Kochkin, 1996). The most

recent look at user satisfaction in background noise found that only thirty seven percent of current hearing aid users were “satisfied” or “very satisfied,” with the performance of their hearing aids in noisy situations, and another twenty four percent reported being “somewhat satisfied” (Kochkin, 2010). Generally speaking, those with acquired sensorineural hearing impairment will find the use of hearing aids to be helpful with hearing and understanding, but it is important for them to understand that, in some cases, even those who wear hearing aids consistently may still have socially disabling levels of communication difficulties associated with their hearing impairment (Jennings, 2005; Weinstein, 2000). Although it is impossible to perfectly predict the performance and satisfaction each hearing aid user will achieve, Kricos (2000) identified several nonaudiological factors that could potentially influence audiological outcomes, including race or ethnicity, gender, age, personality, social support, anxiety, depressive symptoms, locus of control, and availability of social support. In addition, Smith and West (2006) found that hearing aid users who have moderate hearing loss or worse, and hearing aid users with poor word recognition abilities (below 60%) may require additional counseling and formal audiologic rehabilitation programs to increase their hearing aid self-efficacy and overall satisfaction.

It is clear that adults with acquired sensorineural hearing impairment are a diverse population of patients with varying audiologic needs. Further, there is a wide, and often unpredictable, range of success with amplification (Henderson Sabes & Sweetow, 2007). In addition to knowledge obtained through a thorough

case history and a specialized diagnostic test battery, there will always be a certain degree of uncertainty when considering the aural rehabilitative needs of a patient (Katz & White, 2001). It behooves the audiologist to consider the entire scope of patients' needs, including expectations and listening behaviors, as opposed to simply concentrating on hearing thresholds, audiometric configuration, and electroacoustic characteristics of hearing devices (Sweetow, Corti, Edwards, Moodie & Henderson Sabes, 2007). In accordance with the goal of maximizing speech understanding and communication abilities and minimizing the negative effects of hearing impairment, audiologists must be careful to consider the unique needs of patients in order to better determine the direction and specific components of aural rehabilitation for each individual patient.

Components of Aural Rehabilitation: Beyond Amplification

With any decision regarding appropriate assistive technology, it is incumbent upon the audiologist to consider the unique listening needs of the patient and how best to address his or her communication difficulties. In some cases, difficulties with speech understanding are sufficiently addressed by the use of amplification. In other cases, patients may require the utilization of various assistive technologies, more in depth individual or group counseling, or formal training in speech perception or communication strategies, in order to achieve satisfactory speech understanding and communication.

Utilization of Assistive Technologies.

Because difficulties with speech understanding in noisy or challenging listening environments are so common among adults and older adults with sensorineural hearing impairment, audiologists must be careful to consider assistive technology, when appropriate, to aid with speech understanding in these acoustically challenging situations. While listening in noisy public places can be challenging for any adult or older adult with a hearing impairment, these difficulties can be particularly challenging for older adults with cognitive or auditory processing compromises (Kricos, 2006). Each patient must be considered on an individual basis, weighing benefit received from amplification with persistent speech understanding difficulties to determine whether additional assistive technology is an appropriate consideration. Research completed by Jennings (2005) indicated that older adults are not being regularly referred for information and consultation on assistive technologies that assist with safety in the home, ease of use of the telephone and television, and accessibility in public places. Despite this fact, Weinstein (1996) argued that assistive listening devices are an important component of a comprehensive treatment plan, as they serve to enable satisfactory communication.

According to Compton-Conley et al. (2004), there is, in general, a negative correlation between speech understanding abilities and need for an assistive device. In addition to speech understanding abilities, an individual's lifestyle and cognitive ability are important considerations (Kricos, 2006). Weinstein (2000) describes four general categories of devices that are available to

supplement or to be used in lieu of a hearing aid. These four categories include sound-enhancement technology, television and media devices, telecommunications technology, and signal-alerting technology.

Sound-enhancement technology.

While directional microphones in hearing aids have been shown to be advantageous at improving the signal to noise ratio in a noisy environment for a hearing impaired individual, the amount of improvement achieved can be somewhat limited (Compton-Conley et al., 2004; Gnewikow et al., 2009; Valente et al., 1995). Sound enhancement technologies, which pick up a sound source and deliver it to the listener, serve to further improve the signal to noise ratio for the listener, facilitating speech perception and understanding. Examples of this type of technology include hardwired systems, infrared light systems, remote microphones, and most commonly, FM systems.

As stated previously, the typical individual with a mild to moderate hearing impairment can expect to experience a four to five decibel improvement in the signal to noise ratio in ordinary acoustic settings with the use of amplification (Compton-Conley et al., 2004). With the use of FM technology, however, an individual can expect at least a twenty decibel improvement in the signal to noise ratio, regardless of the environment or proximity of the speaker (Compton-Conley et al., 2004). As individuals age and degree of hearing impairment increases, many individuals find that the benefits of conventional amplification become increasingly limited, and could serve to benefit from FM

technology (McArdle, Abrams, & Chisolm, 2005). However, despite the documented effectiveness of FM technology among hearing aid users who continue to encounter significant communication difficulty, the usage rate throughout the United States remains disproportionately low (Boothroyd, 2004; McArdle et al., 2005).

Kricos (2006) cautioned audiologists that although there is a considerable body of literature documenting the efficacy of FM technology for improving speech understanding, audiologists must address the issue of consumer acceptance of this technology. The expense and inconvenience of the device may be prohibitive factors for many patients. Several studies have suggested that reasons for low usage of this type of assistive technology include lack of convenience, cosmetics, need for considerable instruction in device use, and cost (Boothroyd, 2004; Jerger, Chmiel, Florin, Pirozzolo, & Wilson, 1996; McArdle et al., 2005). In Boothroyd's study (2004), none of the participants were interested in purchasing FM technology, although they reported benefitting from it during a trial use of the technology. Kricos (2006) suggested that perhaps changes in the technology, as well as in our counseling strategies, will change the uptake statistics, so that a greater number of adults and older adults will benefit from advances in assistive technology.

One hearing aid manufacturer has developed an exciting, inexpensive alternative to FM technology, which has the potential to benefit many hearing aid users in difficult listening situations. Oticon's ConnectLine system allows users to take full advantage of their Oticon hearing aids' wireless connectivity by

streaming audio from a variety of modern communication and entertainment devices, including their new remote microphone. A recent addition to the Oticon ConnectLine system, the ConnectLine microphone is “a discreet clip-on microphone designed to pick up a companion’s voice, filter out surrounding sound and transmit conversation wirelessly to the user’s hearing aids” (Oticon, 2011). The ConnectLine microphone improves the signal to noise ratio by having the microphone placed close to the chosen speaker, and it also uses an advanced dual microphone setup in order to reduce surrounding background noise (Oticon, 2011). The introduction of an integrated inexpensive technology has the potential to change uptake statistics, making it easier for individuals with hearing impairment to participate more actively and interact more naturally in very challenging situations. At the time of writing, there is not any peer-reviewed research available on the efficacy of the ConnectLine microphone, although research is currently being conducted.

Television and Media Devices.

Most adults watch television on a regular basis. Hearing impairment is known to be a limiting factor for enjoyment of television, as acquired sensorineural hearing impairment often has a negative impact on an individual’s ability to watch and understand television with ease. In a recent study completed by Gordon-Salant and Callahan (2009), it was found that there was no significant difference in recognition of televised speech whether an individual was using personal hearing aids or not. These results indicate that for many older adults, the

use of amplification alone may not be sufficient to improve speech understanding when watching television. Further, there is evidence to support the efficacy of closed captioning, as participants in this same study exhibited significantly better speech recognition scores when using closed captioning (Gordon-Salant & Callahan, 2009).

A specific sub-group of assistive listening devices serve to reduce the effects of distance from the television, ambient room noise, and reverberation when watching television and enjoying other types of media (church service, theatre, movie theatre). Examples of this type of device include infrared systems, FM systems, hardwired systems, and induction loop systems. In addition to these, many hearing aid manufacturers have designed special Bluetooth™ adaptors and transmitters to allow transmission of television audio signals directly to an individual's hearing aids. Examples of this technology include the Phonak TVlink, the Siemens Tek Transmitter, and the Oticon ConnectLine TV Adapter, which allow transmission of the auditory information directly to an individual's hearing aids without a delay. There have currently not been any studies completed to investigate the effectiveness of this type of technology.

Telecommunications Technology.

Telephone usage is prominent among people in all age groups and is important for communication as well as for safety. Hearing aid users are faced with a variety of challenges when using the telephone. The main factors that contribute to difficulties understanding speech over the telephone include absence

of visual cues, problems associated with telephone coupling, including acoustic feedback, and background noise (Picou & Ricketts, 2011; Seelman et al., 2008). In a 2000 study, Kochkin found that the perception that hearing aids do not work with the telephone is a prohibitive factor for hearing aid usage (Kochkin, 2000a).

Telecommunications technologies are any technologies that can augment or be used in place of a hearing aid when using the telephone, which serve to improve speech understanding. In many cases, individuals with hearing impairment are able to use the telephone successfully when utilizing an appropriately fit hearing aid. For some individuals with more significant hearing impairment, using the telephone presents difficulties with speech understanding. Older adults often rely on the telephone to communicate with friends and family members, as well as health professionals and emergency contacts, so it is imperative that those who have difficulty using the phone be made aware of the options that exist (Weinstein, 2000). Examples of this type of assistive technology include handset amplifiers, portable couplers, amplified telephones, and in-line amplifiers. In addition, making an individual's hearing aids compatible with many assistive listening devices and telephones, with the use of a telecoil or the use of a wireless Bluetooth™ device, is an increasingly common solution for many of these individuals.

The use of wireless Bluetooth™ devices has been implemented as a solution to the coupling of digital cellular phone output and hearing aids (Seelman et al., 2008) and has been shown to be an advantageous option for speech understanding when using the telephone (Picou and Ricketts, 2011). In a recent

study, Picou and Ricketts (2011) examined speech recognition over the telephone using multiple presentation protocols for telephone-based listening communication. This study investigated speech recognition abilities with acoustic telephone and both unilateral and bilateral wireless Bluetooth™ signal streaming. They reported that there were significant objective benefits with the use of bilateral wireless speech transmission compared with unilateral wireless speech transmission or acoustic telephone listening as a result of an improved signal to noise ratio when using bilateral wireless speech transmission. There are limitations to the application of this Bluetooth™ technology, as many landline phones are not currently Bluetooth™ compatible. However, some hearing aid manufacturers and other electronics companies have developed Bluetooth™ adaptors to be used with landline phones, such as the Oticon ConnectLine Phone Adaptor. While this technology is still relatively new, it offers hope for overcoming many of the challenges faced in making telephone signals clear and audible for hearing aid users (Seelman et al., 2008).

Signal-alerting Technology.

Hearing is important for both communication and safety. Signal-alerting technology is devoted to alerting to auditory signals, and includes any system that warns, signals, or alerts a person with a hearing impairment, of any degree, to important sounds present in the environment (Seelman et al., 2008; Weinstein, 2000). These technologies are of critical importance for some individuals with hearing impairment, as they may be unable to hear important sounds and alarms

without the use of an assistive device. These technologies include a variety of ways of adapting common household sounds to the needs of the hearing impaired individual, typically either by making the signals lower in frequency where hearing may be better, by making the signals louder to overcome hearing loss, or by coding the signal into a visual or vibratory stimulus (Seelman et al., 2008). Examples of this type of technology include bed shakers, personal vibrating pagers, and flashing lights to signal a variety of sounds, including the doorbell, alarm clock, telephone, burglar alarm, and smoke detector.

According to a 2007 study, the typical signal used by smoke detectors (most peak around 3100 Hz) failed to wake up 43% of tested subjects with mild to moderately severe hearing loss, despite the fact that all were able to hear the sound when awake (Bruck & Thomas, 2007). In contrast, a specific 520 Hz square wave successfully alerted 92% of the subjects at the National Fire Protection Association's standard required volume of 75 dBA at the pillow. Because audiologists have audiometric data and information regarding aided detection abilities of patients, it is incumbent upon audiologists to inform individuals about the system that will best meet their needs. Audiologists should consider making available to the consumer brochures that discuss assistive listening devices as well as the requirements set forth by the Americans with Disabilities Act to ensure that their residence or place of accommodation is in compliance (Weinstein, 2000).

Counseling Individuals with Hearing Impairment.

Informational and Supportive Counseling.

One important tool for helping adults and older adults accept and come to terms with hearing problems is careful counseling. According to the American Academy of Audiology (2006), counseling regarding hearing loss, the use of amplification systems, and strategies for improving speech recognition is within the expertise of the audiologist. Additionally, it is the responsibility of the audiologist to provide counseling regarding the effects of hearing loss on communication and psychosocial status in personal, social, and vocational areas. Both informational and supportive counseling serve as important components of the aural rehabilitation process and can be a critical consideration for individuals with hearing impairment and their family members (Kricos, 2006).

Within the profession of audiology, informational, or content, counseling involves communicating information to patients, specifically regarding hearing impairment, recommendations, and options. Clark and English (2004) describe that the very nature of audiology leads audiologists to be skilled content counselors, as transferring information is fundamental to any diagnosis or treatment plan. Specifically, content counseling includes describing the results of any test or assessment performed (i.e., pure tone audiogram, speech in noise tests, tympanometry, ABR, etc.), as well as communicating what the results of those tests or assessments mean to the patient. Content counseling also involves explaining causes of hearing loss, treatment options, and audiologic rehabilitation,

potentially including a description of current technology and a prescription for amplification.

In regard to content counseling, Clark and English (2004) describe that a great downfall of audiologists is getting caught up in the information transfer and failing to recognize the impact the information may have on the listener. They refer to this problem as the “content trap,” and recommend that audiologists be aware of the difference between content, confirmation, and affective-based questions. Audiologists should strive to be active listeners, conscious of the potential for affective-based questions rooted in emotion, when providing information to their patients.

Content counseling is clearly important in audiology. The majority of the counseling provided by audiologists is based on communicating information to patients. Patients come in with questions, and expect to leave either with answers to those questions or with an idea of where to go to find answers to those questions. The information provided during the content counseling portion of an interaction with a patient is essential in answering the patient’s questions.

Supportive counseling, or personal-adjustment counseling, on the other hand, involves dealing with the emotions associated with hearing loss. Clark and English (2004) state that supportive counseling is often a prerequisite to successful rehabilitation, and that it addresses the emotions and needs underlying patient inquiries. Supportive counseling isn’t necessarily structured, as it varies from clinician to clinician and patient to patient. This type of counseling requires the audiologist to be empathetic and to use active listening, in order to be aware of

instances when patients are asking affective-based questions, and are seeking support. In addition, the goal of supportive counseling should be geared toward patients making positive changes in their lives and requires appropriate and realistic assurances.

Supportive counseling is incredibly important in supporting patients as they come to understand and accept their hearing loss. It is important in helping patients view their difficulties differently, enabling them to build on their new perceptions (Clark & English, 2004). There will clearly be a large range of individual variation in how people adapt to and perceive hearing loss (Souza & Hoyer, 1996), therefore skilled active listening is essential in determining how and when a person is in need of additional counseling.

Ida Institute Motivational Tools: Circles, Lines, and Boxes.

Within any subspecialty of health care, the extent to which a patient follows his or her provider's medical recommendations can be an important factor in determining the beneficial effects of that treatment on the patient's functioning and well-being (Sherbourne, Hays, Ordway, DiMatteo, & Kravitz, 1992). It is recognized that change does not occur without some aspect of motivation for that change (Clark, 2010). These principles hold true in audiology, where patient motivation is an integral part of an individual's acceptance of his or her hearing impairment and the related recommendations. Lack of patient motivation has been evident within the profession of audiology for many years, as illustrated by troubling market penetration statistics. It has been well documented that despite

the aging population and improvements in hearing aid technology, market penetration for hearing aid purchase is not increasing (Kricos et al., 2007), and that only about twenty-five percent of hearing impaired individuals own hearing aids (Kochkin, 1999; Kochkin et al., 2010). Kricos et al. (2007) stated, “The underutilization of hearing aids by adults who potentially might benefit from them should be a major concern to audiologists.”

To this end, the need to engage patients and encourage internal motivation has been a recent topic in a series of workshops for hearing health professionals through the Ida Institute (idainstitute.com). The Ida Institute is an independent, non-profit educational institute in Denmark whose mission is to foster better understanding of the human dynamics associated with hearing loss. Through collaboration with experts in this area, the Ida Institute has put together a set of simple tools that audiologists can use to help patients develop their own internal motivation for seeking rehabilitation for their hearing impairment.

In a recent *Audiology Today* article, Clark (2010) challenged the notion of counseling in audiology, encouraging audiologists to approach counseling in a different way. He suggested that it is the role of the audiologist to set the stage for patients to find their own internal motivation to accept recommendations regarding rehabilitation and to move forward, through recognizing the negative impact of untreated hearing impairment and articulating their own reasons for change. While there may be many approaches to guide others toward motivation, Clark suggested the use of the Ida Institute motivational tools as powerful tools for clinical audiology. These motivation tools, which are comprised of three

geometric figures – circles, lines, and boxes – are designed to be simple and practical tools used to help expose ambivalence and encourage patients to take responsibility for their actions and make appropriate behavioral changes.

“Circles” refers to the use of the circle of change, a cyclical representation of the stages of change that patients may confront when considering aspects of audiological treatment. Clark (2010) described that it is through the understanding gained by taking a thorough case history and listening to patients’ stories that the audiologist can gauge how prepared an individual is to make the changes recommended by the audiologist and required for improved hearing. The use of the circle of change is a helpful tool for visualizing a patient’s preparedness. Those individuals within the stages of contemplation and preparation (as shown in Figure 1) are not yet ready to proceed with recommendations and need to reflect on the attitudes they hold toward hearing care and the need to change (Clark, 2010). In this case, the lines and boxes can be effective tools for guiding patients to a place of preparedness.

“Lines” refers to a visual tool to be used with a patient in order to generate focus and help an individual consider the importance of making a change. It can also be a springboard to help a patient discern what things may be preventing him or her from being able to make a change. To use this tool, the audiologist draws two lines representing a graduated scale from 0 to 10 (Figure 2). The lines are used as a visual tool to establish a ranking of both the perceived benefit of making a change in the individual’s life and a ranking of the individual’s perceived ability to make changes. The first line, used to address the perceived benefit of making a

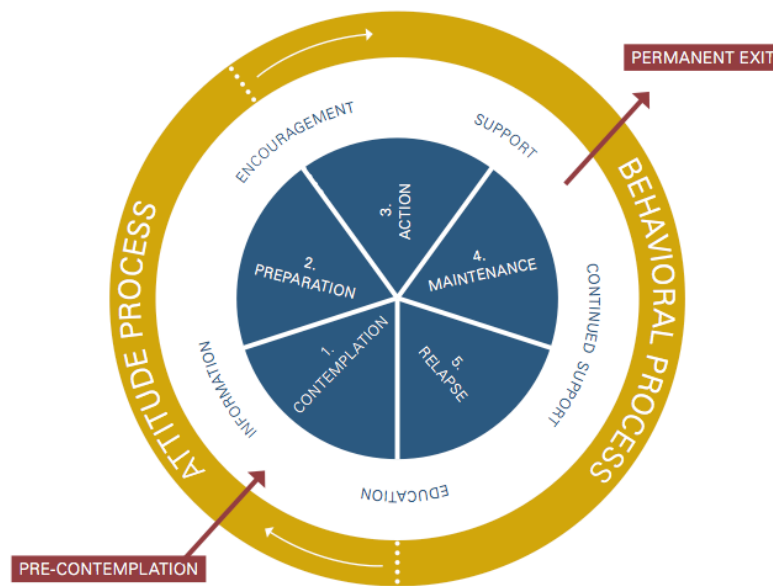


Figure 1: The circle of change.

change, can be used in conjunction with specific difficulties that have been mentioned by the patient throughout the appointment, to help the patient see the potential benefits of making a change. The second line, used to address the individual's perceived ability to make a change, helps the patient to reflect on the difficult processes that may accompany a decision to make a change. These tools can be used as discussion starters, allowing the audiologist to provide information and acknowledge the concerns of the patient. If low scores are given on either line, the use of the boxes is warranted.



Figure 2: The scaling line.

Similar to the lines, “boxes” allow a patient to visualize the costs and benefits of making a change regarding their hearing. The boxes are especially useful for patients who rank themselves low in need to make a change (Clark, 2010). The audiologist directs the patient through discussing the costs and benefits of changing as well as the costs and benefits of the status quo, allowing the patient to lead the conversation and think honestly through the different scenarios. If family members or communication partners are present at the appointment, it is recommended that they also participate when appropriate (Clark, 2010). Once the boxes are completed, it should be evident to the individuals that the benefits of moving forward with treatment recommendations far outweigh the costs sustained by moving forward with this change. Clark suggests that when patients take the time to reflect on the communication difficulties they experience as a result of their hearing impairment, through the use of lines and boxes, the result is typically action.

BENEFITS OF STATUS QUO	COST OF STATUS QUO
POTENTIAL COST OF CHANGE	POTENTIAL BENEFITS OF CHANGE

Figure 3: The decisional balance box.

Collaborative Problem Solving through Group Aural Rehabilitation

As described above, collaborative problem solving frequently occurs in the context of an individual counseling session between audiologists and their patients, with involvement of family members if they are present. While some individual therapy is still being practiced, the most common approach to the implementation of counseling regarding aural rehabilitation is through a group setting (Hawkins, 2005). Kricos (2006) argued that group aural rehabilitation is an even more effective means of engaging in collaborative problem solving. In this type of setting, the audiologist works with a group of individuals to identify typically occurring communication problems and to discuss solutions to these problems while providing information, training, and psychosocial support. Group aural rehabilitation can be especially advantageous, as it allows the person with hearing impairment to share feelings, problems, and solutions with others, developing relationships with peers and being able to give and receive support (Hawkins, 2005; Kricos, 2006). In addition, the audiologist is able to provide rehabilitative services to many individuals at the same time, making this form of aural rehabilitation more financially feasible for both the audiologist and the individual with hearing impairment. Further, this type of group setting allows for the opportunity to include significant others and family members in the rehabilitative process in a formal way, which has been shown to be beneficial to the individual with hearing impairment (Preminger, 2003).

Recently, Hawkins (2005) conducted a systematic review of the evidence in order to investigate the effectiveness of group aural rehabilitation programs.

This study compared thirteen studies that evaluated group aural rehabilitation programs. This review concluded that there are short-term psychosocial benefits from adult aural rehabilitation groups including reduced self-perceived hearing handicap, improved perceived quality of life, and improved use of communication strategies. However, this study and others have demonstrated that there is not overwhelming evidence to support the long-term benefit of these programs (Hawkins, 2005; Hnath-Chisolm, Abrams, & McArdle, 2004). Hawkins (2005) and Preminger (2007) suggest that the lack of standard group programs has likely contributed to the diversity of results in published studies evaluating group aural rehabilitation programs. In a review of the issues associated with the measurement of the effectiveness of group aural rehabilitation programs, Preminger (2007) suggested the need for future studies to investigate the effect of class content, instructor training, participant demographic characteristics, and experience of the participants on psychosocial outcomes in group aural rehabilitation programs. A more in depth look at which factors lead to measurable psychosocial benefits would facilitate the development of standard programs in aural rehabilitation and would lead to more accurate assessment of the short-term and long-term success of group aural rehabilitation.

To this end, a recent study by Preminger and Yoo (2010) measured short- and long-term improvement on the hearing loss-related quality of life scale as a result of participation in one of three group aural rehabilitation classes. The results of this study revealed that the content of the class had only a minimal influence on treatment outcomes. The recommendation of these authors is that

group aural rehabilitation classes should be geared toward providing information, training, and psychosocial exercises (Preminger & Yoo, 2010).

Formal Training in Speech Perception and Communication Strategies.

In some cases, in order to reduce the impact of communication difficulties, it is necessary for an individual with acquired hearing impairment to participate in some form of formal training in speech perception and communication strategies. There is evidence to suggest that formal auditory training in adult hearing aid users can lead to improvements in sound localization, memory for nonverbal sounds in sequence, auditory closure, and greater benefits in reverberant and noisy environments (Gil & Martinelli Iorio, 2010). In addition, while speech perception and communication strategies training is commonly thought to be reserved for patients with significant deficits and poor communication skills, there is evidence to support that formal training can be beneficial for any person (Henderson Sabes & Sweetow, 2007).

Speech perception and communication strategies training programs have historically been considered a foundational component of aural rehabilitation programs. The goal of any of these types of training is to overcome the speech perception and communication deficits that result from a permanent acquired hearing impairment (Gagné & Jennings, 2000). Research has shown that this type of formal training enhances speech perception performance, increases self-perceived competence, and reduces self-perceived handicap (Boothroyd, 2010; Sweetow & Henderson Sabes, 2006). In addition, a systematic review of the

evidence suggested that many of these benefits of individual training are generalizable to everyday conversations and real world interactions (Sweetow & Palmer, 2005). Despite this fact, it was also discovered that while the majority of clinical audiologists offer aural rehabilitation in the form of amplification, most do not offer any kind of communication training (Sweetow & Palmer, 2005). There are several options for formal training in this area, including computer-based auditory training, the use of recorded materials, and communication strategies training with a clinician, either on an individual level or in a group (Boothroyd, 2010).

Auditory Training.

Auditory training programs allow the listener to enhance both knowledge and skills important for speech understanding by spending time on speech perception tasks without the demands, constraints, uncertainties, and risks associated with everyday real world communication (Boothroyd, 2010). Several rehabilitative techniques have been developed in recent years, in the form of computer-assisted self-instruction. Many of these programs are adaptive, in order to provide speech perception and auditory training for adults and older adults with acquired hearing impairment. Available options include:

- 1) Listening and Communication Enhancement (LACE: Sweetow & Henderson Sabes, 2006) from Neurotone (www.neurotone.com).

LACE is one of the most popular programs currently available. It is a home-based interactive computerized training program designed to

improve listening and communication skills via the use of an adaptive paradigm (Gordon-Salant, 2006; Sweetow & Henderson Sabes, 2006). The program sharpens skills in the areas of understanding degraded speech, auditory memory, and cognitive skills, and it also provides helpful communication tips for users throughout the training. Like any formal training program, LACE requires a commitment. Research indicates that those with greater degree of hearing impairment have more motivation to complete the training (Henderson Sabes & Sweetow, 2007).

2) Auditory: Brain Fitness System by Posit Science

(www.positscience.com). This training program claims to sharpen the auditory system through applying principles of perceptual learning and brain plasticity to improve both speech understanding and cognitive function (Gordon-Salant, 2006).

3) Computer Assisted Speech Perception Evaluation and Training

(CASPER: Boothroyd, 2010), available through hearingresearch.org. This collection of programs provides auditory, visual, or auditory-visual learning opportunities at the vowel and consonant level as well as at the sentence level (Boothroyd, 2010).

4) Seeing and Hearing Speech from Sensimetrics

(www.seenigspeech.com). This interactive CD-ROM allows users to train and practice lip-reading at their own pace and at home. It is not

limited to auditory training, but provides visual and auditory-visual learning opportunities as well (Boothroyd, 2010).

- 5) Sound and Way Beyond (Fu & Galvin, 2007), available through Cochlear Americas (www.cochlearamericas.com). This self-paced, interactive software application was originally designed to enhance development of listening skills in cochlear implant recipients, but is also efficacious for individuals who use amplification.
- 6) eARena, available through Siemens (www.siemens.com/hearing). This program is also an interactive auditory training program that provides both instruction and practice with both speech and environmental sounds.
- 7) Read My Quips from Advanced Hearing Concepts (www.sensesynergy.com). Research indicates that this adaptive program significantly improves speech recognition in noise for those who use it for the suggested duration of three weeks. It is designed to be entertaining and provides both visual and auditory cues (Boothroyd, 2010; Levitt, 2010).

Another option used by many implant centers and clinical audiologists is the recorded book. Recorded materials, such as audio books, are useful in that an individual can listen to a recording and read along in the book at the same time. While this approach is not adaptive or interactive, it is advantageous due to

inherent interest, low cost, and minimal need for equipment and computer literacy (Boothroyd, 2010).

In addition to the improvements in hearing aid self-efficacy and speech perception performance mentioned above, there is a great deal of evidence to suggest that participation in a computer-based auditory training program can actually reduce the hearing aid return rate (Hawkins, 2005; Hnath-Chisolm et al., 2004; Kochkin, 2000a; Martin, 2007). While this is an encouraging finding, the current body of research lacks information as to whether these improvements lead to increased participation and improvements in quality of life (Boothroyd, 2010).

Communication Strategies Training.

While auditory training is efficacious in improving speech-understanding abilities, these types of programs do not address interpersonal communication variables. Communication strategies training programs focus on improving and facilitating communication, rather than simply focusing on improving speech perception (Gagné & Jennings, 2000). This type of training can be completed in a one-on-one setting with an individual and a clinician or in a group setting with a clinician. Boothroyd (2010) suggests that individual training is advantageous in that it can be tailored to meet the needs of an individual and can provide personal counseling regarding confidence and assertiveness. While there are benefits to individual training, in many cases it is impractical or impossible to implement because of the cost and the time required from the clinician. In many cases, group training may be more appropriate. Although group training may involve less

tailoring to individual needs, it reduces the cost involved. In addition, there are potential psychosocial benefits from interactions within a peer group, as discussed above (Boothroyd, 2010).

Whether in a group setting or on an individual level, communication strategies training can serve as an important confidence-builder, and is often overlooked as a component of aural rehabilitation. Many programs of this kind have been designed to help individuals with hearing impairment manage communication more effectively. In addition, it can often be beneficial to include family members or other communicative partners in communication strategies training, as the attitudes and behaviors of individuals who communicate with individuals who are hearing impaired can have an impact on the success or failure of a conversational exchange (Gagné & Jennings, 2000).

Tye-Murray (1994) suggested that communication strategies training should include two general categories: facilitation strategies and repair strategies. The author describes facilitation as the behavior used to prepare for and manage an ongoing conversation, including both anticipatory and attending strategies. Facilitation would also include the ability to manage the environment of a conversation with respect to lighting, noise, and reverberation, as much as possible (Gagné & Jennings, 2000). In most cases, patients can learn these strategies and can then teach their communication partners in order to reduce the number of communication difficulties. Repair strategies, on the other hand, are described as behaviors that are applied when a breakdown in communication occurs, which are used to overcome this difficulty (Tye-Murray, 1994). In the

case of a miscommunication or communication breakdown, an individual could ask for repetition or could ask their communication partner to rephrase, simplify, elaborate, or provide the topic of the message in order to repair the communication. These small changes in conversational style and the use of communication strategies may result in significant improvements in the success of conversations for individuals with hearing impairment.

Chapter 4: Considerations for Patient-Centered Aural Rehabilitation

It is clear that adults with acquired sensorineural hearing impairment are a diverse population of patients with varying audiologic needs and a wide, and often unpredictable, range of success with amplification (Henderson Sabes & Sweetow, 2007). The evidence has shown that those with acquired sensorineural hearing impairment will find the use of hearing aids to be helpful with hearing and understanding, however, there will be individuals who still have socially disabling levels of communication difficulties associated with their hearing impairment (Jennings, 2005; Weinstein, 2000).

There is sufficient evidence to indicate that aural rehabilitation extending beyond hearing aids is efficacious in improving speech understanding abilities as well as quality of life for many patients. While hearing aids constitute the most important component of intervention for adults and older adults with acquired sensorineural hearing impairment, aural rehabilitation should be considered an integral component of a holistic approach to hearing health care. Sweetow et al. (2007) argue that audiologists must be convinced that the implementation of holistic, effective, efficient, and individualized aural rehabilitation is in the best interest of their patients, as well as the future of the profession.

Audiologists have an important role to play in helping patients and their families manage their communication difficulties. As the baby-boomers age and the number of older adults continues to increase, audiologists are in the position to help a substantial number of patients face the challenges they will face and be able to participate in a variety of communicative activities. Based on the evidence examined in this paper, audiologists must be careful to examine the specific impairment and handicapping effects

of that impairment in order to better determine the direction and specific components of aural rehabilitation for each individual patient. It is incumbent upon the audiologist to consider the entire scope of their patients' needs, including expectations, listening behaviors, and facets of communication actually encountered in daily situations, as opposed to simply concentrating on hearing thresholds, audiometric configuration, and electroacoustic characteristics of hearing devices (Kricos, 2006; Sweetow et al., 2007).

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